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WEATHER, p. 2 FRI: 72°F | 53°F Partly Cloudy SAT: 68°F | 51°F Partly Cloudy

Friday, September 21, 2018

Science GIR class enrollment drops Registration data reveals significant

impact of experimental P/NR policy

By Soomin Chun

Preliminary registration data following the implementation of the Pass/No Record experiment for the Class of 2022 shows significant changes, according to Vice Chancellor Ian Waitz in an interview with *The* Tech. Compared to last year, there were over 500 fewer enrollments in the core Science, Mathematics, and Engineering (SME) GIRs, especially in biology and chemistry.

The number of students taking three or four SME GIRs in their first semester decreased from 76 percent in 2017 to 45 percent this fall, according to class registration data as of Sept. 16. Instead, students took more "exploratory courses," with the number of unique classes that firstyears registered for increasing by 10

In the 2018 Orientation Survey sent out by the Office of the Vice Chancellor, the number of students who said it was "very important" that a subject fulfilled requirements dropped, whereas the number of students marking "a chance to explore

a potential department in which to major," "interesting material," and "chance to learn something new" as very important increased, both relative to last year.

The OVC will compile a more extensive set of comparisons after add date, according to Waitz.

These data points are the result of an experiment led by the OVC and approved by the Committee on the Undergraduate Program in July. As part of it, students in the Class of 2022 are eligible to designate up to three additional SME GIRs to be graded as P/NR after their first semester.

"I decided not to take any GIRs this semester and instead take some computer science classes to try and see if I would be interested in that," Daniel Sun '22 said in an interview with The Tech. Sun is currently a Course 18 considering Course 6 as

"Since I can get GIR classes on P/ NR later, I chose not to take any GIRs this semester so I can get more P/NR classes overall," Akshaj Kadaveru '22

GIRs, Page 2



TechMart, a grocery store that opened in the Walker Memorial building Monday, aims to provide at-cost groceries to students after Star Market closed down in the spring.

At-cost grocery store opens in Walker Memorial this week

TechMart offers produce, dairy, bread, frozen food

By Rujul Gandhi

TechMart, an at-cost grocery store for MIT students, opened Monday in Walker Memorial (Building 50). Since the closing of Star Market, a popular, close-tocampus destination for affordable groceries, in February, students have needed an alternative.

TechMart offers a selection of fruits, vegetables, dairy, bread, sauces, frozen food, and spices, among other items. All the produce is "at-cost," which means no markup is charged on the price at which it is obtained from the wholesaler. Milk at TechMart costs \$2.26, an apple costs \$0.49, bread costs \$1.50, and a carton of eggs costs \$1.79.

The shop is located at and operated by Rebecca's Cafe, on the second floor of Walker. TechMart accepts dining dollars (with the standard five percent discount) as well as TechCash, and operates from 3-11 p.m. on weekdays. It is closed on weekends.

The logistics of setting up TechMart were managed by the Division of Student Life, according to a statement from Mark Hayes, director of campus dining, in an email to The Tech. Staff from DSL and a committee of students from various undergraduate and graduate associations worked on the location and produce selection.

The store has been positively received by students so far.

Ajay Jain '20, who lives in East Campus and cooks for himself, told The Tech in an interview that he finds the location convenient for East Campus residents. Deeksha Sinha G, while happy with the prices, said that TechMart could improve in terms of selection of items.

TechMart is a pilot project being undertaken to reduce food insecurity at MIT. In September 2017, a survey by the student group Class Awareness, Support, and Equality (CASE) found that 11.6 percent of undergraduates could not afford food at some point during their

In response, the Food Inse-

TechMart, Page 2

IN SHORT

Final exam schedules have been published at finalexams.mit.edu.

Today is Career Fair. First-years and volunteers can enter starting at 9:30 a.m., while general access begins at 10 a.m. The fair will end at 4 p.m.

The deadline to add a full-term subject is Oct. 5. This is also the deadline to designate subjects as sophomore exploratory or junior-senior P/D/F. Plan

Interested in **joining** *The Tech*? Stop by for dinner Sunday at 6 p.m. or email join@tech.mit.edu.

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MIT's first humanist chaplain

Greg Epstein encourages discussions about 'why'

By Kelly Wu

ever humanist chanlain at the Institute. The other chaplains are enthusiastic about the new hiring, since they recognize that there is a large group of secular and nonreligious people at MIT, Epstein said in an interview with The Tech.

Meetings with faculty, deans, and administrators have been positive, and the MIT community overall has been pleasantly surprised with the addition, Epstein said. Epstein hopes to begin meeting with students soon, as the fall semester is

When asked to explain humanism, Epstein quoted the title of his book: "good without God." He explained humanism as a secular way

of living an ethical and meaningful life. A humanist outlook stresses the MIT's Office of Religious Life is importance of thinking about the welcoming Greg Epstein as its first- why of one's life and holds that the they gave up chances to be with famanswer lies in human connections According to Epstein, humans are social, and so they should create ethical, respectful, and meaningful relationships with each other that eventually benefit society.

Epstein views his role as humanist chaplain to be that of a supporter, listener, and discussion facilitation leader for the students and the MIT community. "I really want students to make big decisions as thoughtfully as they can," Epstein said.

Epstein said that at MIT, students are working hard to succeed in classes, plan startups, and land internships and jobs at the companies of their dreams, but students should put an equal amount of energy into figuring out why they want to succeed. He said he "knew people who worked so hard for money that ily, [and] make a difference in the world."

Epstein believes it is essential to have the "why" discussion now, when students are young, rather than later in life. Most importantly, Epstein wants to facilitate conversations between students, specifically conversations about supporting one another, accepting vulnerabilities, and finding personal purpose in life.

One specific way that Epstein is getting involved with student campus life is through a new weekly discussion-based event. Epstein has partnered with Student Minister Nina Lytton SM '84 to offer a dis-

Chaplain, Page 2

MIT Corp. member Bodman dies at 79

Bodman served as Sec. of Energy

Samuel Bodman ScD '65, a member of the MIT Corporation and former U.S. Secretary of Energy, died Sept. 7 in El Paso, Texas after a long battle with primary progressive aphasia. He was 79.

After receiving a bachelor's degree in chemical engineering from Cornell University, Bodman joined the MIT community, completing a ScD degree in the same field in 1965, according to biographical information compiled by the White House archives. Shortly afterwards, he served as an associate professor of chemical engineering at MIT.

He followed his work in educa-

By Susanna Chen tion with a career in finance. In 1983, he because the president and chief operating officer of Fidelity Investments. Five years later, he joined Cabot Corporation, a specialized chemicals company, and served as chief executive officer and director.

Bodman was confirmed unanimously by the U.S. Senate to the position of Secretary of Energy under the George W. Bush administration in 2004. As leader of the Department of Energy, he oversaw security issues at the Los Alamos National Laboratory and managed a budget of over \$23 billion.

Bodman, Page 3

HISTORY OF REQS

Reflecting on changes to the first year. FEATURES, p. 4

MANIC, BEAUTIFUL CHAOS

Mandy is one of the best horror films this year. ARTS, p. 6

MAGICAL MYSTERY HOME

Return to your childhood with warlocks and witches. ARTS, p. 7



POLITICAL GEOMETRY

Researchers use mathematics and computing to assess gerrymandering.

SCIENCE, p. 9

GUIDE TO GRAD SCHOOL

One woman's journey through MIT's math maze. ARTS, p. 8

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Good weather for career fair, another cool down to come

By Jordan Benjamin STAFF METEOROLOGIST

The weather today will be good for Career Fair activities as a seasonable but breezy and humid air mass overspreads the area in advance of a strong cold front Friday Night. On Saturday, Boston will begin to transition to very fall-like weather as cool, dry air surges into the region. By Sunday night, temperatures could dip to around 50°F and high temperatures next week could struggle to edge far above 60°F. This cool, crisp and dry weather will jump start and accelerate the emergence of vivid fall foliage and is a marked transition from the train of humid and/or warm air masses that have in succession dominated our weather over the past few weeks. Get out and enjoy the weekend!

Extended Forecast

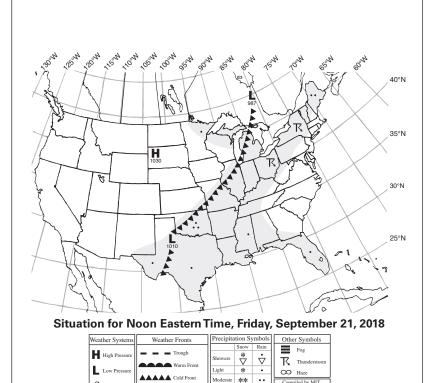
Today: Partly cloudy. High around 74°F (23°C). Winds SW at 10-15 mph.

Tonight: A slight chance of showers, otherwise mostly cloudy and breezy. Low around 67°F (19°C). Winds south at around 15 mph.

Tomorrow: Partly cloudy. High around 72°F (22°C). Low around 53°F (12°C). West winds at 10-15 mph becoming north late.

Saturday: Partly cloudy. High around 68°F (20°C). Low around 51°F (11°C).

Sunday: Mostly sunny. High around 63°F (17°C).



OVC to reform advising

GIRs, from Page 1

said in an interview with The Tech. "Also, I can enjoy my first semester more."

In addition to the new GIR policy, Waitz revealed other developments the OVC is work-

ing on, such as plans to reform advising so that students get a network of advisors instead of one first-year advisor in a random major, as well as a shorter, IAP version of the Designing the First Year class offered last

Epstein serves

Chaplain, from Page 1

cussion group, where any MIT student can come and discuss topics related to how to live a meaningful, ethical, and community oriented life.

Epstein wants to be able to help people start understanding the impacts of technological change on our basic ideas of community and relationships. MIT, to him, is the best place to start to understand these impacts because the Institute is at the forefront of technological innovation, Ep-

make

Before coming to MIT, Epstein served as humanist chaplain at Harvard for 13 years, starting in 2005, and continues to serve in this role. He is also the author of Good Without God: What a Billion Nonreligious People Do Believe, and is frequently cited as one of the leaders of the national humanist movement.

Epstein is also one of five MIT chaplains that serve as "conveners," people who work to convene meaningful conversations at the Institute, especially between people of different heliefs

TechMart housed in Rebecca's Cafe

TechMart, from Page 1

curity Solutions Working Group (FISWG) was created by Chancellor Cynthia Barnhart PhD '88 and Vice President and Dean for Student Life Suzy Nelson. The group published a report in March 2018, with a low-cost grocery market or pantry on campus as one of the key recommendations.

The FISWG also found that since most dining options are on the west side of campus while academic buildings are on the east side, students would rather continue working than travel to the dining halls for meals. TechMart is located in east campus, closer to many academic buildings, and so might be more convenient for students.

The Tech found about half a dozen shoppers at TechMart on its opening day, but only a few or no shoppers on two subsequent

Shoppers in TechMart can give feedback on comment cards, and students can email suggestions about their experience to foodstuff@mit.edu.





Friday, September 21, 2018

THE ASSAULT ON INTELLIGENCE

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NATIONAL SECURITY
IN AN AGE OF LIES



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Joining the talk is Joel Brenner,
former senior counsel of the NSA
and head of US counterintelligence, DNI

Tues, Sept 25 | 4:30 - 6:00 PM

MIT 10-250, 222 Memorial Dr, Cambridge

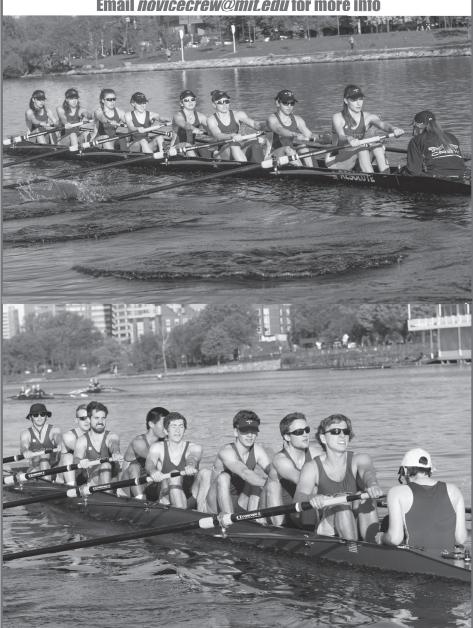
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'He loved MIT,' M. Diane Bodman says

Bodman, from Page 1

"Sam Bodman has shown himself to be a problem solver who knows how to set goals, and he knows how to reach them," George W. Bush said in his 2004 remarks on Bodman's nomination.

Bush also wrote in a statement released Sept. 7, "Sam had a brilliant mind, and [Laura] and I are fortunate that he put his intellect to work for our country as Secretary of Energy. I am proud that he was a member of my Cabinet, and I am proud that he was my friend."

Along with his nomination to the office of U.S. Secretary of Energy, Bodman also served as the Deputy Secretary of the Treasury and the Deputy Secretary of Commerce.

He later became a member of the MIT Corporation, serving on the Executive and Investment Committees, before being granted the title of life member

"Sam led an extraordinary life of leadership and service in business, academia, and government. MIT was the very fortunate beneficiary of his time, talent, and wisdom in so many different capacities over the years. We are saddened by his loss but grateful for his impact on the Institute and well beyond," Robert Millard, chair of the MIT Corporation, told MIT News.

Bodman is survived by his wife, M. Diane Bodman, three children, Elizabeth Mott, Sarah Greenhill, and Andrew Bodman, and two step-children, Perry Barber and Caroline Green.

"He loved MIT. He thought it was the finest institution in the world of its kind. He felt MIT really changed his life," Ms. Bodman told MIT News.

Solution to Got Money?

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Solution to Not a 6-3

from page 10

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FRIDAY, SEPTEMBER 21, 2018 4 THE TECH

FEATURE

Evolution of the first year academic experience *A history of the changes in curriculum, policy, and programs affecting the first*

year at MIT

By Whitney Zhang FEATURES EDITOR

This year, freshmen can designate up to three Science, Mathematics, and Engineering (SME) General Institute Requirements to be graded on a Pass/No Record basis after their first term. This experiment marks a bold initiative to reevaluate the curriculum of the first year and the broader first-year experience, and a continuation of MIT's increasing encouragement of freshman exploration. In light of the experiment, it is timely to reflect on the history of the first-year academic experience at MIT.

The early years

MIT's first class, in 1865, consisted of only 32 freshmen. The required courses were mathematics, mechanical drawing, free hand drawing, elementary mechanics, chemistry, English language and literature, modern languages, and military tactics. All freshmen took these classes together.

Mathematics included algebra, plane trigonometry, solid geometry, and spherical trigonometry. Elementary Mechanics included the "general doctrine of motions and forces," mechanics of solids, mechanics of liquids and gases, and "phenomena and laws of sound." Chemistry included "chemistry of the non-metallic elements" and "chemistry of the metals." The "modern languages" requirement consisted of learning French and

Dr. Deborah Douglas, Director of Collections and Curator of Science and Technology at the MIT Museum, wrote in an email to The Tech that learning French and German was necessary because they were the language of most science and technology papers and textbooks. She also explained that drawing was a requirement because in the 19th century, engineering was centered around drawing machines. With the onset of the 20th century, mathematical analyses took precedence, and so the mechanical and free hand drawing classes were gradually phased out.

In addition to classes, all students were required to do drills and receive instruction in military science in the MIT Corps of Cadets. The U.S. Congress passed the Morrill Act in 1862 to provide states with federal lands that could be sold to fund colleges. The Massachusetts legislature's decision to provide funds to MIT included a requirement to "provide instruction in military tactics." Each week, first and second year students trained with each other for an hour and a half, albeit with poor equipment and limited resources.

Beginning in 1908, all first-year students were required to take lectures in personal training and hygiene, exercise two hours a week with an instructor, and complete physical exams at the beginning and end of the school year.

The Lewis Report: Foundations of MIT's HASS system

In 1947, MIT commissioned the Committee on Educational Survey, chaired by Warren K. Lewis. In 1949, the committee published The Report of the Committee on Educational Survey, known as the Lewis Report. This report examined MIT's principles of education and provided recommendations for the MIT curriculum that became the foundations of the current MIT academic experience.

At this time, MIT had risen to increased prominence as a result of WWII. In addition, the number of public universities was increasing, bringing into question the value of private higher education. As a result, the committee grappled to establish MIT's institutional purpose.

The committee decided that MIT must "provide a kind of education that cannot be obtained elsewhere" and could only do so by "improv[ing] the education that we now offer and to extend[ing] it into new and promising areas hitherto undeveloped." The report argued that MIT should create the Committee on Undergraduate Policy in order to "provide a means for concentrated and unified effort toward achieving the distinction in undergraduate education to which the Institute should aspire."

Furthermore, Douglas wrote, at the time there was an "existential issue regarding the real and perceived threat of fascism." Faculty found that course curricula were similar to that of a Soviet university and that "the kind of student MIT was educating was being trained to conceive, design, operate, and manage large technological systems that had the same centralizing tendencies as did communist governing systems." As such, there was an increased emphasis on the preservation of democracy through civics and the humanities.

Thus, during the course of the study, an auxiliary committee, the Committee on General Education, was commissioned in order to focus specifically on providing undergraduates with "broader and more effective cultural training." Their recommendation focused on "strengthening and broadening the facilities for education in the social sciences and the humanities at the Institute" and recommended extending the HASS GIR requirement from 8 subjects to 10 subjects and including HASS subject sequences.

As a result of these recommendations, MIT created the Committee on Undergraduate Policy — now the Committee on the Undergraduate Program (CUP) - which provided a central body to oversee the undergraduate educational program, and the School of Humanities and Social Sciences.

In 1951, the HASS requirement was changed from two terms of composition and six terms of humanities to a four HASS-subject sequence in the first two years, a three-subject concentration in years 3-4, and one elective.

In 1948, the swim test was instated, after a recommendation from the Athletics Association Study Committee. There are many false rumors about the origins of the swim test, including one that posits, "The son of prominent alum X drowns, prompting the alum to donate in the son's name ... under the stipulation that a swim test be required in order to receive a diploma." Years after, the PE requirement was increased to six points, and then to eight points.

The Zacharias Report: Foundations of MIT's science core and distribution requirements

In 1962, MIT commissioned a faculty committee, chaired by Jerrold Zacharias, to review the undergraduate curriculum, particularly the science requirement. The committee report, published in 1964 — referred to as the the Zacharias Report — tackled many issues that are still pertinent today, including whether or not students should begin by learning the pure sciences, whether emphasizing readingand lecture-based science subjects undermined the 'resourcefulness' and efficacy of students," and the tension between training students for their professions versus enriching them for their broader lives. Ultimately, the report recommended a more diverse and flexible Science Requirement.

Faculty voted to approve the report's recommendations. The science core was changed from four semesters of physics, four semesters of math, and two semesters of chemistry to two semesters of physics, two semesters of math, one semester of chemistry, three elective classes, and one elective laboratory subject from a list of Science Distribution subjects.

The Science Distribution classes included subjects like Thermodynamics, Organic Chemistry, Crystallography, and Differential Equations. The Science Distribution laboratory requirement included subjects like Design of Experiment, Engineering Design and Manufacture, and Experimental Electronics.

The elective laboratory was not to teach about a specific subject matter or field, but rather was to "give the students some real idea as to what laboratories are and what is meant by solving experimental problems in science and engineering." The other three electives were meant to be a balance between exposing students to a common core of fundamental science subjects and a recognition of the diversity of students.

The HASS system (developed as a result of the Lewis report) and the science core and science distribution requirements (developed as a result of the Zacharias report) form the basis of the HASS GIR and SME GIR requirements that we have

Later changes to the GIRs

In 1974, the HASS requirements were changed to an eight-subject Hum-D distribution requirement, of which students had to take at least three subjects in three separate fields, and a three-subject concentration requirement in a single field, in order to "achieve some degree of depth" in that field.

In 1988, under recommendation from an Institute-wide committee chaired by the late Professor of American History Pauline Maier, the Hum-D distribution requirement was changed to a HASS-D distribution requirement. The change imposed more structure and restricted class selection for the requirement in order to "ensure that students receive a broad and cohesive exposure to the humanities, arts, and social sciences."

In 1990, biology was added to the science core, and the science distribution was replaced with a restricted elective in science and technology and decreased by one subject.

In 2000, the writing requirement was replaced with the communication requirement.

In 2001, the first TEAL class, 8.02T, was instated and deemed a success by faculty. One study found that TEAL doubled studen ing gains. However, student reviews were more mixed. In a column in The Tech, one student complained that the computers froze during presentations, the slides had typos, and that the problem set questions were vague. These problems were eventually fixed, and, by 2005, almost all physics classes were taught in a TEAL format.

In 2010, the HASS-D distribution requirement was removed and replaced with the current HASS requirement of three distribution components of one HASS-A (arts), one HASS-H (humanities), and one HASS-S (social sciences); three or four subjects in a concentration; and one or two electives.

In 2012, edX was launched and first used by ESG and Concourse for

Pass/No Record

In 1968, Pass/Fail was enacted as a four-year experiment for the freshman class in order to ease student anxiety, to help students compensate for differences in secondary school education, to

give students more freedom in choosing classes, and to improve instructor-student relationships. In addition, a credit limit of 60 units in the fall and and 63 units in the spring was implemented. Students received feedback through twice-a-term Freshman Evaluation Forms.

Reviews of the unit limit were mixed. Some felt that the limit was good for preventing students from overburdening themselves, but others felt that the limit change was counterproductive to Pass/ Fail's purpose of furthering freshman exploration. On the other hand, students were very "overwhelmingly supportive" of Pass/ Fail, according to a study done by sociologist Charles L. Stannard in the Spring of 1971. One student wrote a letter published in The Tech saying, "If it had not been for pass/fail [sic], I would have drowned."

Asv thus, Pass/Fail was not ended after four years. Instead, in 1973, it was made permanent and changed to Pass/No Record in order to encourage freshmen to further explore classes.

Faculty were concerned about the lack of ability to give students feedback, and so in 1982, formal "hidden grades" were added in the spring.

In 1988, the Committee on the First Year Program, chaired by Kenneth Manning (referred to as the Manning Committee), recommended a more "flexible" firstyear program that included ending Pass/No Record in the second semester and changing the minimum "Pass" grade from a C to a D.

Based on the Manning Committee's recommendations, faculty chose to change the minimum "Pass" grade to a C, but did not end Pass/No Record. In addition, they lowered the unit limits to 54 in the fall and 57 in the spring.

In 1995, the Freshmen Evaluation Forms were eliminated and were replaced with formal "hidden grades" for both the fall and spring semesters, as well as a "Fifth Week Flag" that notified students after their fifth week if they were failing

In September 2000, a subcommittee of CUP recommended that freshmen in their spring term be graded on A/B/C/NR instead of Pass/No Record. The change was originally suggested by Professor of Literature Travis R. Merritt and Professor of Anthropology Arthur Steinberg. Steinberg felt that Pass/ No Record was leaving students unprepared for their sophomore year. Students, however, strongly referred Pass/No Record

The change was approved in 2002. It reduced the number of students who received Ds and Fs in their classes, but sophomore grades did not improve.

This year, in order to foster "a more exploration-focused experience," freshmen can designate up to three SME General Institute Requirements as Pass/No Record after their first term. The Office of the Vice Chancellor recommends that students take one exploratory course their freshman year. This year's policy is an experiment in part resulting from the Designing the First Year, a class targeted at enhancing the first-year experience at MIT. The Class of 2021 will serve as the control group.

Freshman Orientation and

Prior to 1969, All first-years were advised by faculty in a traditional model. By 1975, much fewer faculty were advising students, and 50 percent of advisors were non-faculty and 35 percent were graduate students. Briefly, from 1977-1979, the Office of Freshman Advising was faculty run.

In 1984, the Freshman Advising Seminar began. In 1992, traditional advising was eliminated, 80 percent of students participated in one of 112 seminars, and the other 20 percent were not advised. At this time, unlike today, most Freshman Advising Seminars were not faculty

The earliest evidence of Early Sophomore Standing is in a reference to the Profile of the Freshman Class in 1985. Early Sophomore Standing allows freshman students to become sophomores in their spring semester. Students are graded, advised, and credit-limited as sophomores.

In 1995, the current advising model began. Freshmen were either enrolled in a seminar or traditionally advised.

The first Freshman Pre-Orientation Program (FPOP), "Freshman Leadership Program," debuted in 1996. Around the same time, "Discover Ocean Engineering" (DOE), the first academic exploratory program, debuted. There are now over 25 FPOPs.

Freshman orientation in its modern form began in 1997. Prior to this, orientation activities were "integrated" with fraternity rush and referred to as R/O.

In the 2000s, Residence Based Advising (RBA) was introduced in McCormick Hall, with modified versions in Random Hall, Chocolate City, German House, and Spanish House. Upperclassmen Residence Associate Advisors would work with a faculty/staff advisor to advise a group of 8-10 freshmen. In addition, they would work with Residence Life Associates (RLAs), who would guide the RBA program and provide dormwide events. RLAs eventually evolved into the current Residential Life Area Directors. Initial reviews of RBA were mixed. Some students felt that they could help "build community" in their residences, but others felt that it would deprive students of the ability to join freshman advising seminars and feared that it was endemic of increasing administrative control.

The Freshman Learning Communities

Freshman Learning Communities provide students the opportunity to learn in small, interactive classes within a community-based program and set physical space, and include first-year advising and

TheExperimental Study Group (ESG) began in the fall of 1969 as an educational experiment founded order to encourage independent work, interpersonal communication, and active student involvement. There were originally no classes (although students could choose to attend regular MIT classes) and students could choose their own topics to study. Students were not required to read from MIT course textbooks or complete assignments. In 1980, ESG was formally given status under the School of Science. ESG offers classes that cover all of the SME GIRs, as well as several HASS classes and seminar

Concourse was founded the year after by Professors Louis Bucciarelli and David Oliver of the Department of Aeronautics and Astronautics and sponsored by the Commission on MIT Education in order to establish a cooperative curriculum between the sciences, the humanities, and engineering. Concourse offers classes that cover the mathematics, chemistry, and physics GIRs. Freshmen are required to take CC.110: Becoming Human: Ancient Greek

FRIDAY, SEPTEMBER 21, 2018

Perspectives on the Best Life in the fall semester and attend Friday seminars in both terms.

The Integrated Studies Program (ISP) began in 1989 and integrated coursework in the humanities, sciences, and engineering. Students enrolled in SP.353: Technologies and Cultures, and SP.354: Technologies in Historical perspective. Students could also attend a special ISP only 8.01X recitation section. In 2002, ISP was replaced with Terrascope.

Media Arts and Sciences's (MAS) first-year program was founded in 1999 to introduce students to university research, the Media Lab community, and "intersection of technology and communication/expression." Students take MAS.110: Fundamentals of Computational Media Design in the fall and MAS.111: Introduction to Doing Research in Media Arts and Sciences in the spring. MAS offers recitation sections for chemistry and physics

GIRs and a variety of seminars.

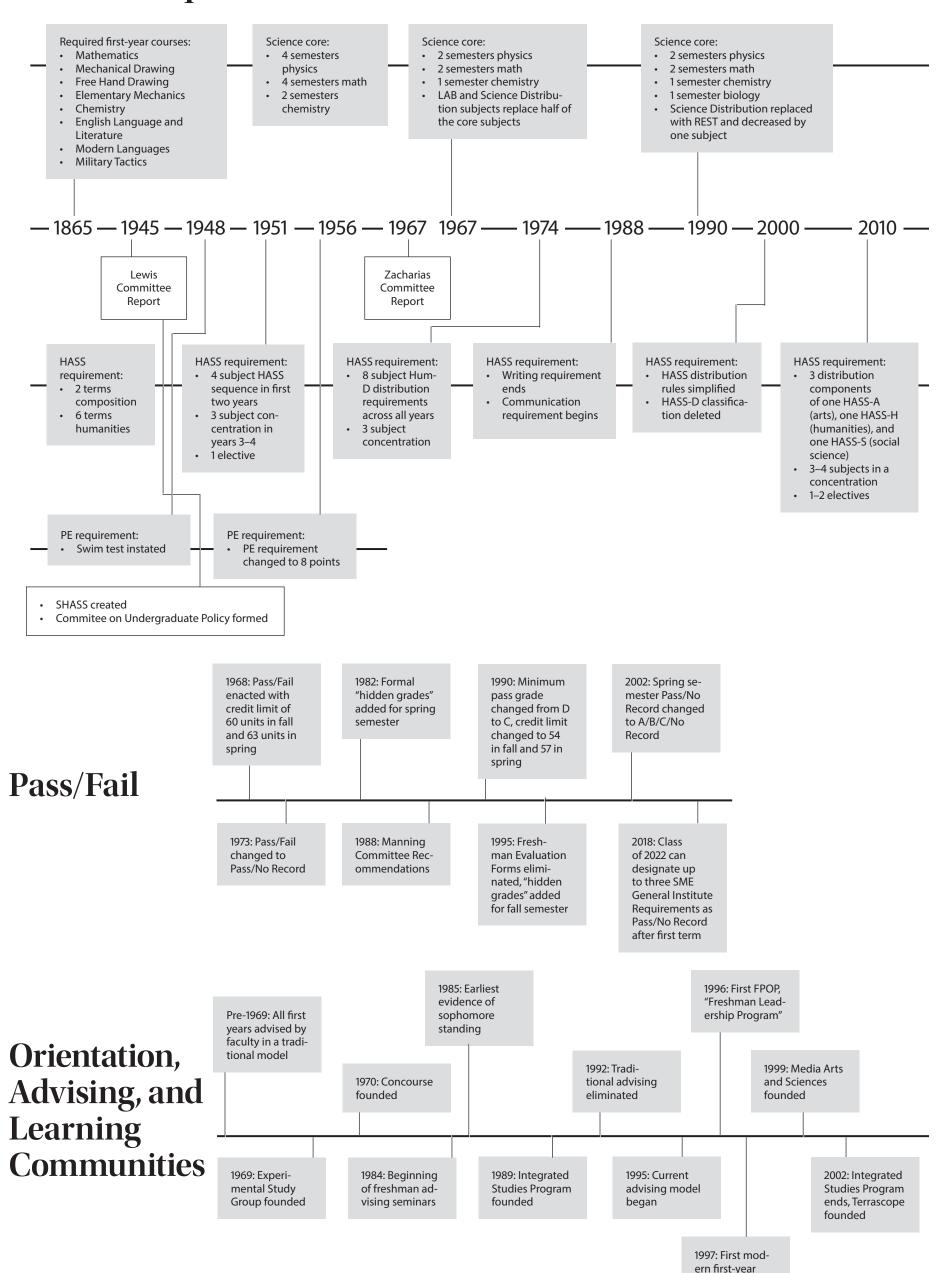
Terrascope was founded in 2002 by Civil and Environmental Engineering Professor Sallie "Penny" Chisholm and Professor of Earth, Atmospheric, and Planetary Sciences Kip Hodges as the educational arm of the Earth System Initiative (ESI) (not to be confused with the current Earth Science Initiative). ESI, also formed in 2002, was developed to "foster and facilitate multidisciplinary research and education

efforts in earth and environmental sciences." Terrascope grew out of 12.000: Solving Complex Problems, a class created by Hodges in 2000; the class continues to be the cornerstone of the program. The class gives freshmen the opportunity to take charge of their own work by putting them in charge of tackling a "Mission," a complex earth systems problem. Originally, during the spring semester, students took 1.016: "Design for Complex Environmen-

orientation

tal Issues," in which they designed and built museum exhibits. In the current version of the class, now listed as 2.00C[J]/1.016[J]/EC.746[J], students design and prototype specific solutions to aspects of the year's Mission. Students also have the option of taking SP.360, Terrascope Radio, in which they develop a radio program, and going on a spring break trip to investigate their Mission first-hand. Terrascope does not offer GIR classes.

Institute Requirements



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MOVIE REVIEW

The beautiful chaos of *MANDY*

A delightful homage to '80s horror film and revenge flicks, MANDY will make you cower, laugh, cry, and most of all, have a great time

MANDY

Directed by Panos Cosmatos

Written by Nate Bolotin

Screenplay by Panos **Cosmatos and Aaron** Stewart-Ahn

Starring Nicolas Cage, Andrea Riseborough, Linus Roache, Bill Duke, Richard Brake

Not Rated, Now Playing

By Alex Sandberg

I had taken interest in MANDY since early murmurings started to come out of Sundance earlier this year, where it premiered. It featured Nicolas Cage: someone who, in my opinion, is highly underrated or mocked as an actor despite the depth of his characterization.

MANDY is, in that sense, the perfect vessel for Nic Cage's talents.

The movie opens with a sweeping view of a forest with King Crimson playing in the background. The scene is set as 1983, with Reagan speaking on the radio about a spiritual awakening in America. This is meant to be some version of our reality — not quite the same but not completely different either. We spend the first half of the movie delving into the relationship and intimacy behind Red Miller (Nicolas Cage) and the titular Mandy (Andrea Riseborough). The two of them live in a cabin full of windows in the middle of said woods — Mandy an artist, Red a lumberjack.

Jóhannsson's soundtrack in this first half of the film is soft, almost nostalgic. We see these two laying in bed shortly afterwards, having those middle-of-thenight conversations that anyone who's ever shared space with someone they love would know about. Those conversations mean everything and nothing. Even the light seems to coat these two with a certain softness. It is as if the intimacy these two share in their performance manifests as a literal aura; the dark blue lighting of night is cut by a ray of red over the couple as they talk about their favorite planets. The chemistry between these two characters is palpable, but it is exactly this bond that is so important for making the stakes seem so high later in the film.

Paradise doesn't last long in this movie. Only about 20 minutes in do we get our first look at the antagonists of this story a band of, in Red's words, "Jesus freaks," led by the unhinged Jeremiah Sand (Linus Roache), a Charles Manson-esque figure who takes a liking to Mandy after seeing her walking down the road. The entire scene where Sand's truck passes Mandy is colored a deep red, with an off-putting, droning sound setting the tone. They are later joined by a cadre of otherworldly bikers, allegedly deformed by a batch of bad acid.

The latter half of the movie, after chaos rains down upon Red, is a gory, violent, drug-fueled revenge thriller. There's your fair share of heads exploding and chainsaw battles. There's Nic Cage's character getting high on the mystery substance the bikers drink, causing his face seemingly melt off. One particular scene involving a car window being put up and down several times had the theater cracking up. There's even a Cheddar Goblin that vomits mac-and-cheese all over a group of kids in an in-universe advertisement (yeah, you heard that right).

But for all the gore and campy fun in this movie, the experience of watching it is a constant befuddlement over whether you should be laughing or cowering. There's a scene involving Red in his bathroom after the climax of the movie, drinking half a bottle of vodka straight from the bottle and screaming, pouring it alternately into his mouth and over his wounds. It's a scene that I'm sure will be added into numerous "Cage Rage" compilations in the near future, but honestly, that does a disservice to the scene. We hear screams from the bottom of Red's gut, a pained cry that is almost animalistic. The screams transform into sobs and, from there, into pure rage as Cage stares right into the camera, almost as if looking straight at the viewer.

MANDY is a visceral experience. We join our characters in their darkest places. We hear Red's voice take on a demonic quality when he finally reaches — and overpowers – Jeremiah Sand. We feel the love between Mandy and Red. We feel Red's grief and fury. We feel ourselves attacked by Sand's flavor of abuse. It is not an easy watch. But it is a watch that will stick with you for days and weeks afterwards.

Nicolas Cage and Andrea Riseborough both give the performances of a lifetime in this movie, as do — for that matter — most of the cast. The visuals and music are flawless. This movie is so good that I cannot say enough about it, and I fully recommend that you watch and support it. You will not be disappointed. Legion M President Jeff Annison, in my interview with him last week, described MANDY as, first and foremost, "batshit crazy," and he was absolutely right. It's crazy, it's fun, it's terrifying, and it's beautiful, but most of all, it's one of the best movies out this year.

MOVIE REVIEW

Guide dogs work hard

Pick of the Litter demonstrates the challenges of training guide dogs with mixed results



COURTESY OF SUNDANCE SELECTS

Primrose, guide dog puppy at Guide Dogs for the Blind, gnaws on a rope.

By Ethan Vo

ASSOCIATE ARTS EDITOR

As a person who adores dogs, I saw Pick of the Litter with the expectation of lightearted fluffy entertainment So when the footage of the Twin Towers collapsing and photos from the Iraq war started playing, I was a bit taken aback by the film's more serious discussions than the promotional material would lead someone to expect. The reason for the inclusion of these scenes was that Roselle, a guide dog from Guide Dogs for the Blind (GDB), led her handler from the 78th floor of the World Trade Center during the Sept. 11 attacks.

While these scenes are the most extreme examples, they demonstrate the flaws and successes of Pick of the Litter. The film solidifies itself as an edifying documentary — beyond mere cutesy fare — while occasionally suffering from tonal whinlash and lack of focus.

Pick of the Litter follows a litter of five puppies as they train to become potential guide dogs under the organization GDB. The 'P' litter hosts a variety of personalities: rowdy Patriot, sleepy-looking Phil, easily distracted Potomac, and the well-behaved girls, Primrose and Poppet. Despite this premise, the majority of the film is actually spent concerning the humans. The film

bounces between testimonials from people with visual impairment, the struggles of the handlers, and GDB in its practices and testing methods. Due to the thoroughness of GDB, less than half of all dogs trained make the cut to be a guide dog due to various reasons such as food allergies or high levels of energy.

Herein lies most of the issues of the documentary. For some bizarre reason, the film uses a framing device reminiscent of reality television of a competition between the dogs in which the film tracks which dogs are eliminated from the program. Since most of the focus is on the handlers' personalities however, it was difficult to understand the characters of the dogs apart from Patriot and Phil. Structurally, this device also contributes to sudden shifts in tone, where the playfulness of the dogs can immediately change to a heartfelt confessional. Due to the lack of a main narrator, the film instead relies on awkward graphics and intertitles that disrupt the flow of the narrative. The incidental music of the film is also subpar, which has the potentially dangerous effect of cheapening the documentary to cute animal videos with stock music.

Despite these flaws, the film provides fascinating insight on the complexities of raising a guide dog. For example, the main point emphasized in the film is nonobedience training, in which guide dogs must disobey an order if it puts the owner in harm's way. This is emphasized in traffic training, where dogs must actively provide a buffer between cars and disobey the handler's orders if it leads into traffic. These practices lead to some gripping footage

★★★☆☆

Pick of the Litter

Directed by Dana **Nachman and Don Hardy**

Screenplay by Dana Nachman

Starring Patriot, Phil, Poppet, Potomac, **Primrose**

Not Rated, Now Playing

where the GDB instructors have to safely drive right at the dog and blindfolded handler. The psychological and cultural aspects of the GDB handlers are also quite interesting. For example, GDB transfers Phil after six months to a more experienced handler, leaving the previous handler devastated, who was unaware that GDB had planned this from the start. The difference in attitudes between the clinical objective approach of GDB and the emotional attachment of the handlers gives the documentary thought-provoking content. While the direction of Pick of the Litter could have been improved, the documentary is worth watching, especially for dog lovers. The film's laidback portrayal of a highly specific community is informative and sometimes even exciting. The dogs are really cute, too.

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MOVIE REVIEW

'You can't vote for me if you have no arms'

Childhood vibes, magic, and cheap scares combine

★★★☆☆

The House With a Clock in Its Walls

Directed by Eli Roth

Screenplay by Eric Kripke

Based on the novel by John Bellairs

Starring Jack Black, Cate Blanchett, Owen Vaccaro, Kyle MacLachlan

Rated PG, Now Playing

By Nathan Liang
ASSOCIATE ARTS EDITOR

From horror director Eli Roth comes *The House With a Clock in Its Walls*, an interesting departure from his usual lineup of films.

Newly orphaned Lewis Barnavelt (Owen Vaccaro) has moved to New Zebedee to live with his eccentric Uncle Jonathan (Jack Black). Lewis quickly realizes that things are not exactly as they seem. The house feels alive with its shifting mosaics and endless array of clocks, and every night, there's a distinct ticking in the wall he can't quite ignore. When Lewis has finally had enough of the unknown horrors, he attempts to escape for fear of his life — just to finally have his uncle reveal to him the nature of the house. It's a magic house that used to belong to an old and powerful warlock, Isaac Izard (Kyle MacLachlan). Having known Isaac, Jonathan, a fellow warlock, took over the house for him and maintains it with help from his next door neighbor, a witch by the name of Florence Zimmerman (Cate Blanchett).



Lewis (Owen Vaccaro) examines his uncle's magic house.

I found it hard to try to qualify my initial impressions with the film until Lewis goes to school for the first time in his new environment. It had hit me by then that the whimsical, childhood-driven feel of the movie reminded me of films I had watched in my childhood such as *Halloweentown* and *The Sorcerer's Apprentice* (yes, the one with Nicolas Cage in it) — not necessarily amazing, life-changing films, but they were fun to watch at the time and easy to consume as a young movie watcher.

So, what did I like? I liked the introduction to the world of magic in this film. It has that initial *umph* of amazement, but that first impression only lasts so long before everything feels like overdone parlor tricks. Compared to the contemporary likenesses of Newt Scamander and Doctor Strange, the world of Lewis Barnavelt admittedly feels old-fashioned and not as awe-inspiring.

Another thing I liked about the film is the dynamic between Uncle Jonathan and Miss Zimmerman and the resulting hu-

mor. The two are like a bickering old married couple despite never entertaining a romantic relationship before and during Lewis's story. There are moments when they just quip back and forth in a way that could make any audience member giggle, but there are also moments that really draw you in, like when the two of them work together. It's the times when the warlock and witch duo explore the world of magic in their own way that felt really compelling to me, but unfortunately it made the rest of the movie bland in comparison.

And that takes me to what I didn't enjoy as much in *The House With a Clock in Its Walls*. Overall, the film relies pretty heavily on classic movie tropes to carry the plot of the film, from the cool, mean kid to the ignored, innocent love interest to the naive kid who should really know better. It contributes to the old school charm of the film, but again, this is not necessarily always a good thing. It also felt hard to follow Lewis's character development and sympathize with him. At first, Lewis is

smart and clever; and yet his intelligence is undermined by later actions that only frustrated me. I couldn't imagine why Lewis couldn't have used his apparent smarts to guide him through the story rather than let his emotions overtake him for the majority of the film. Yes, it is true that he is only just a child, but the impression of his character from the start of the film leaves much to be desired as the film progresses.

As it turns out, the motivation behind the movie's primary antagonist also leaves much to be desired. Throughout the film, you're led on to believe that his motives are mysterious and complex. When it comes to the actual reveal, I was underwhelmed by the absurdity of the claim and almost ready to check out by then.

Overall, *The House With a Clock in Its Walls* would probably be a fun watch for the kids, but mom and dad may be itching to leave by the end. I also now have a certain image of Jack Black in my head that I wish could be erased from my mind, so there's that

MAGIC SHOW REVIEW

Prepare to be amazed

One fantastic magic show has just hit the streets of Boston



COURTESY OF CHAMPIONS OF MAGIC

Fernando Velasco escapes from the Jaws of Death.

By Nathan Liang
ASSOCIATE ARTS EDITOR

As some of you have probably realized by now, I am quite the movie fanatic. I've grown up with movies like *The Prestige* and *Now You See Me* that have charmed me with a special fondness for magic. However, having seen movies like *Now You See Me*, I had entered the Champions of Magic show expecting a huge arena, massive contraptions, mind blowing

illusions, and dumbfounding moments. The only letdown was that the venue was a small, regal theater instead of a large-scale, modernday arena.

The Champions of Magic team consists of five members, each with their own special talents and brands of magic. There's Young & Strange, a comical dynamic duo who specialize in classic magic illusions, some imbued with their own personal twist, Fernando Velasco is the whimsical escape artist, Kayla

Drescher is the bubbly close-up trick magician, and Alex McAleer is the charming mind reader. All have their own strengths and weaknesses, but they combine well to make one amazing and surprisingly hilarious show.

The amount of audience interaction with the Champions of Magic was expected but still appreciated. Being the magicians that they are, they interfaced frequently with their audience, from older folks to reluctant dudes to adorable children who had barely even begun to comprehend the idea of magic and were utterly astounded by it. The magicians were also light-hearted and friendly. Their joy in spreading the wonders of magic were almost infectious, especially when you share seats with a particularly enthusiastic crowd. I particularly liked how they set up a trick right before intermission with the express purpose of getting everyone involved in the magic. You may not have been the one chosen to reveal the answer, but it was still remarkable to feel like you could contribute and participate in the secrets of the magicians.

Focusing on the actual magic, the Champions of Magic made sure to provide a variety for their audience to take in and process. They presented your standard card trick and daring, death-defying escape and even had some original crafted tricks from the magicians themselves. It wasn't hard to be amazed by the impossible feats they presented on stage and it was definitely refreshing to see the magic performed live when you've come from a background primarily

Champions of Magic

Starring Young & Strange, Alex McAleer, Kayla Drescher, and Fernando Velasco

Boch Center Shubert Theatre

Sept. 20-23

watching magic tricks on a digital screen. There's just something about seeing the magic in front of you, without the possibilities of video editing, that's really indescribable. It's physically being there for the suspenseful setup and flawless execution and contributing to the awe-inspired applause that makes going to a performance like this worth it. You can't help but appreciate the amount of time and effort these magicians have probably put into perfecting their craft. Even when they feign disappointment at supposedly slipping up on a particular trick, you're still sympathetic to their journey towards becoming some of the world's best magicians.

If you've got no plans for the weekend and want some real magic to spice up your life, Champions of Magic is the way to go!

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SARTS ARTS ARTS ARTS

THEATER REVIEW

Speaking her truth in grad school

Joys and struggles at MIT

Truth Values: One Girl's Romp through MIT's Male Math Maze

Written and Performed by Gioia De Cari

Central Square Theater

Sept. 12-23

By Mark Goldman

Truth Values peeks into the life of Gioia, an MIT Ph.D. candidate in logic, from the moment she gets accepted till she leaves MIT with a master's. Based in the author's own experiences at MIT, this autobiographi-

cal one-woman show portrays the rawness of MIT grad school as I've never seen in theaters before. The subtitle, "one girl's romp through MIT's male math maze," adequately describes the isolation and gender discrimination emphasized through the play. However, the challenges Gioia faced, like finding

friends, switching advisors, and having a father's death impact her graduate studies, speak to truths experienced by many in graduate school.

The play is an impressive single-person performance, and Gioia De Cari does an amazing job impersonating the various characters she faces along the way. The performance is aided by a projector, complementing well the statements and movements Gioia makes. Even with this, the theater space still seemed massive relative to the intimate connection created as Gioia's qualifying exam extension is rejected after her father commits suicide.

While the play would resonate with many MIT students, we don't seem like the intended audience. The play emphasized common MIT tropes, like the impersonal number-

ing of buildings and courses, and "drinking from a firehose," giving them a much longer explanation than would be needed for MIT students and creating a more simplistic picture of the institute than many at MIT would recognize.

Towards the end of the play, when Gioia decided to not get a Ph.D., the viewer was left to wonder which of her experiences caused her not to finish with her Ph.D. Grappling with simplifying the complex factors, be it love for theater, trouble making friends, her father's death, imposter's syndrome, or discriminatory comments, the audience is left at a loss to find a simple explanation. At closing, Gioia circles back to her training as a logician, mentioning that a continuum exists between true and false, highlighting the complexity of the graduate school experience.



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Districts and data

Justin Solomon and a cohort of Boston-based researchers use modern computing power to tackle gerrymandering mathematically

By Eli Sanchez

Every 10 years, following the national census, electoral districts in the United States are redrawn. This process is undertaken to satisfy a constitutional requirement that each district within a state — or local district within a jurisdiction — be comprised of roughly the same number of people. In theory, this process is meant to prevent communities from losing or gaining influence in elections through the shifting of a state's population. In practice, redistricting is often exploited by partisan bodies — typically state legislatures — for the very opposite: to manipulate the political clout of certain voting blocs to influence the outcomes of elections.

This opportunistic use of the redistricting process — commonly known as gerrymandering — is widely reviled as one of the most undemocratic practices employed in American politics. It has been leveraged throughout U.S. history to establish advantages for political parties, protect incumbents, and marginalize or empower certain demographics, and is often implicated as the root of many of our political system's ills, such as congressional gridlock, runaway elections, and ideological extremism in government.

Why, then, does a practice so fundamentally undemocratic persist in a nation whose political ethos is imbued with democratic principles?

Justin Solomon, Principal Investigator of the Geometric Data Processing Group at MIT, is a prominent member of the Metric Geometry and Gerrymandering Group (MGGG), a cohort of Boston-based computer scientists and mathematicians that are leveraging modern computing power to study the problem of fairness in redistricting with a level of quantitative rigor that has not been possible until recently.

"From my perspective, one of the big challenges in redistricting is that we lack clear, quantitative standards for evaluating the fairness of redistricting plans" said Solomon. "For that reason, there's no clear path to a standard that's easily enforceable and understandable."

"Our effort, broadly, is... to assemble a clear set of standards and a way to talk about the redistricting problem in a fashion that's quantitate and that's fair and easy to apply," he told *The Tech*. "That includes a lot of different aspects. Everything from understanding the shape of a district and what bearing it has on the outcome of the vote... to understanding the big space of all the different ways of dividing up a state."

To date, most attempts to contest partisan gerrymanders in court have failed due to the lack of a clear, convincing standard against which to judge them. But Solomon's work, and that of his colleagues in the MGGG holds the potential to fundamentally reshape the debate around gerrymandering by offering a feasible means

of formulating and implementing such a standard for the first time in U.S. history.

Previous work by Solomon involved evaluating the utility of various compactness scores, metrics designed to quantify how "weirdly-shaped" a district is. Some examples of compactness scores include the ratio of a district's area to the square of its perimeter multiplied by 4π (Polsby-Popper score), or the ratio of a district's area to the area of the smallest circle that completely encloses it (Reock score).

But a district's compactness doesn't tell the whole story. "The reality is these districts are designed with so many different criteria in mind," Solomon explained. "One is the shape. Others include compliance with civil rights law... [T]here are plenty of districts that really were designed quite carefully to give a particular minority a voice, in which case maybe you needed a crazy shape to pull that off."

Reliable and convincing metrics for quantifying the fairness of redistricting plans must be able to accurately account for a host of complex and interrelated factors. Formulating these metrics remains a thorny, open problem for Solomon and the MGGG. But even once they've identified metrics that are legally practicable, they will have to work out feasible methods for implementing them, a problem that is far from trivial.

"There's a huge space of plans that follows the rules as we've laid them out," Solomon explained. It would be impractical to require states to iterate through all of them and identify the fairest plan under any given metric.

So, with the brute force approach out of the question, Solomon and his colleagues have had to devise clever procedures for applying these metrics. They have been developing an approach akin to a statistical outlier analysis, a technique that would require detailed, though approximate knowledge of the shape of the distribution of redistricting plans, rather than all possible plans and their associated fairness scores.

"[N]ow, I can look at the plan that was proposed by the legislature and I can say 'how likely is it that, in that huge set of things that follow the rules, I could have accidently stumbled upon the one the legislature found?"

"If you notice that, in the space of plans, your plan is an outlier, then you have a pretty strong argument that there is something nefarious going on."

Though in its infancy, this type of analysis has already been used to litigate gerrymandering disputes with some success. Notably, in *Common Cause v. Rucho* — a recent case brought before a panel of federal judges — a redistricting plan proposed by the North Carolina state legislature was deemed a partisan gerrymander based on a similar analysis carried out by Jonathan Mattingly, a professor of statistics at Duke University. The plan was rejected as uncon-



LILLIE PAQUE

Justin Solomon is a member of the Metric Geometry and Gerrymandering Group (MGGG), a group of Boston-based researchers developing computational algorithms for quantifying the fairness of voting districts to better understand the problem of gerrymandering.

stitutional on these grounds, though the legislature may choose to appeal the decision to the Supreme Court.

The *Rucho* decision is especially interesting because the panel of judges found that their ruling was consistent with existing legal precedent, leaving open the possibility that this type of argument may gain widespread acceptance as a standard for arbitrating gerrymandering disputes. The challenge, then, for Dr. Solomon and the MGGG is establishing a firm enough understanding of the enormous and complex space of redistricting plans for this approach to be applied reliably in legal contexts.

"When you invoke that kind of argument, you have to be confident that you have a representative sample, that you've walked around in this space a sufficient amount and so on," Dr. Solomon explained.

"The ways of dividing up a state or a country or a country or a school district is this huge combinatorial space, and this is really the first time in history that we've had the computational power to be able to explore that space with any level of certainty or understanding to make a clear argument."

Because this space has remained largely unexplored until recently, quite a bit of work remains to establish a firm understanding of it. But even so, Dr. Solomon and his colleagues have decided to pursue the ambitious goal of having workable prototypes of these techniques ready by the 2020 census. This would enable quantitatively rigorous analyses of redistricting plans proposed throughout the country after the census, and potentially offer a feasible route to successfully challenging gerrymanders that arise from the process.

And they're not just trying to develop

analysis techniques that can be used by expert witnesses in court. Rather, they hope to make these analyses accessible to the general public in the form of open-source software packages, giving average citizens a voice in how their electoral districts are constructed.

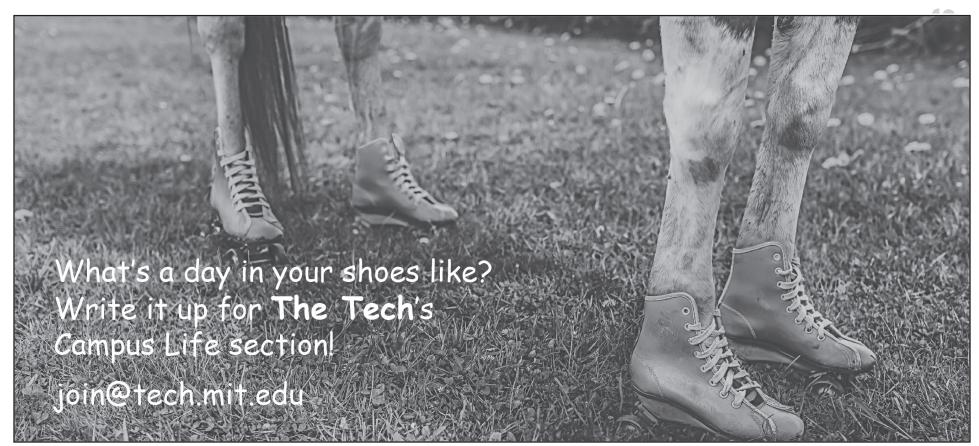
"We have software that's under development that does Markov chain Monte Carlo analysis in the space of districting plans," Solomon told *The Tech*. This technique involves randomly sampling values of a fairness metric and evaluating the probabilities that these values will occur in the space of redistricting plans. The distribution of the metric is then approximately reconstructed based on this data, and subsequent sets are gathered to obtain more accurate approximations.

"We're working really, really hard to make it stable, reliable and easy to use, so that if you're trying to argue about your congressional district, then maybe all you have to do is load in the shape files that come from GNS software and give it a shot!"

"These are heavy-duty mathematical tools that require a little bit of nuanced understanding. But the vision is really to democratize this process."

It's a hopeful vision: a democratic solution to one of the most undemocratic problems plaguing American politics. But if the MGGG succeeds in deploying tools and methodologies for identifying partisan gerrymanders that are able to convince judges, it would represent a monumental step towards eliminating this practice's pernicious effects on our democratic system. And thanks to the efforts of math- and computer-savvy experts like Justin Solomon, as well as modern advances in computing power, a step like this may be within reach for the first time in history.

SCIENCE SCIENCE SCIENCE SCIENCE



Recruit Me

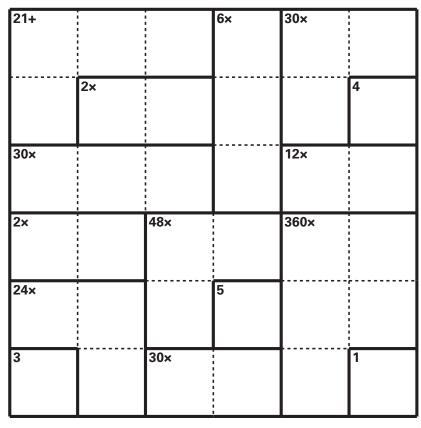
Solution, page 12

2	9		7	4	1			
	6	1		5	9			
				2				1
			1			7	5	3
6	1	7			4			
4				1				
			4	8		9	3	
			9	7	2		1	5

Instructions: Fill in the grid so that each column, row, and 3 by 3 grid contains exactly one of each of the digits 1 through 9.

Not a 6-3

Solution, page 3



Instructions: Fill in the grid so that each column and row contains exactly one of each of the numbers 1–6. Follow the mathematical operations for each box.

False Front by S.N. Solution, page 12

ACROSS

- 1 Isle near Naples 6 Bring up
- 10 Photo
- 13 German industrial city
- 14 Red Muppet
- 15 Grandson of Eve
- 17 Unbelieving nature* 19 "Jasmine" side dish
- 20 Paltry sum
- 21 Early afternoon
- 22 Big name in sci-fi novels
- 24 Hosiery shade
- 26 Trade org. 29 A Fish Called Wanda star
- 30 Elemental bits
- 32 Nightmarish 34 Despicable character
- 35 Category
- 37 S&L offerings
- 38 Eroded
- 39 Smart set* 43 Year after Y2K
- 44 Senior member
- 45 Make a slip
- 46 What a laser is often

- aimed at
- 47 Craig's boss in Casino Royale
- 49 Eminent
- 53 Exercise based on martial arts
- 55 Hard to comprehend
- 57 Divulge
- 58 M*A*S*H procedure
- 60 With 62 Across, a question of confirmation
- 62 See 60 Across 63 Gate expectations: Abbr.
- 64 Remorseful*
- 68 Sense offense
- 69 Breach
- 70 Classy quality
- 71 Law & Order characters
- 72 Late-night host Meyers
- 73 Long stories

DOWN

- 1 Contemporary of Piper
- 2 Invite to dinner
- 3 What can precede the three starred answers

- 4 Social standing, for short
- 6 Inlet, for instance
- 7 One of two quarterback
- 8 Pre-noon hrs.
- 9 Capitale europea
- 10 Dire straits
- 11 Unfriendly
- 12 Tropical fruits
- 18 "Little" suffix in music
- 23 Do up-in-the-air
- acrobatics
- 25 Send forth
- 27 Systematized knowledge
- 33 Be deserving of
- 36 Swiss surrealist
- 39 Disclosed

- 43 Murmur complaints

[2028] Complex Numbers

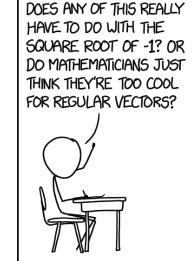
- 5 Delighted by
- brothers

- 16 Unforgiving

- 28 Certain undercover cop
- 31 Iditarod participant
- 40 "You should try that"
- 41 Go ashore
- 42 Syrian __ Republic
- 48 Well-being
- 15 19 18 22 23 20 24 30 35 38 39 |40 44 46 47 53 54 58 60 62 63 64 65 66 68 69 70 72
- 50 Whirlpool sister brand
- 51 Beethoven's Third
- 52 Low pair
- 54 Enjoys, with "in" 56 Money maker
- 59 Pencil holders, at times
- 61 Quiche ingredients
- 65 Quiche, essentially 66 All the time, in odes

67 Page of history

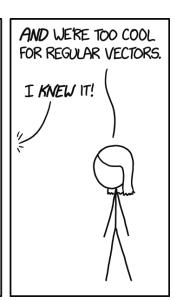




NUMBERS, LAYING THE FOUNDATION FOR THE FUNDAMENTAL THEOREM OF ALGEBRA AND THE ENTIRE FIELD OF COMPLEX ANALYSIS.

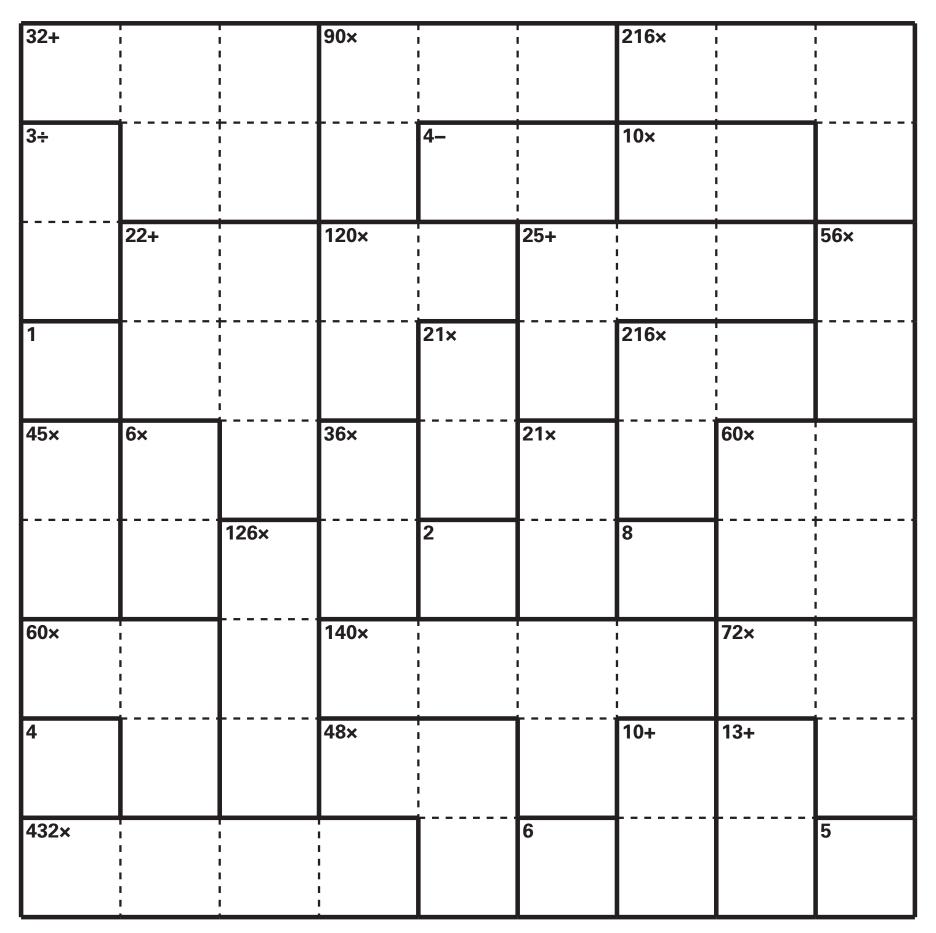
COMPLEX NUMBERS AREN'T JUST VECTORS.

THEY'RE A PROFOUND EXTENSION OF REAL



geometry and geometric algebra are the same thing.

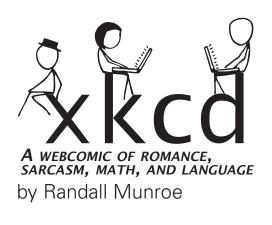
Solution, page 3

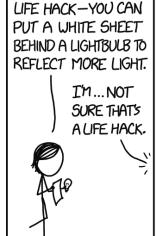


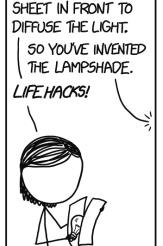
Instructions: Fill in the grid so that each column and row contains exactly one of each of the numbers 1–9. Follow the mathematical operations for each box.

[2024] Light Hacks

I DISCOVERED A COOL







AND YOU CAN PUT A

FREEMAN DYSON SUGGESTED THAT ADVANCED CIVILIZATIONS WOULD BUILD SPHERICAL SHELLS THAT SURROUNDED THEIR BULBS, REDIRECTING 100% OF THEIR ENERGY. YES, THEY HAVE



WELL, THEY MIGHT. INFRARED SURVEYS ARE INCONCLUSIVE. YOU KNOW YOU CAN JUST CHECK THEIR WEBSITE. OOH, GREAT LIFE HACK! NO!

12 THE TECH

Be a PENguin write for us e-mail join@tech.mit.edu

Civil Engineer needed!

I'm looking for an engineer to perform some load calculations for a decking project that I am working on.

I'm looking for someone with a background in Statics and Structures. I have a list of specific questions dealing with live loads and dead loads and materials of construction.

Payment will be at a rate of \$40/hr. We can agree upon an estimated number of hours and a completion date when we meet.

This is little more than a sophomore-level homework problem, so why not get paid for helping solve a real-world problem?

 ${\tt Contact: Gary\ Riggott, \it riggottg@mtl.mit.edu}$

Email us at join@tech.mit.edu

It would be turtley

join The Tech

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For a list of opportunities and to apply, visit alum.mit.edu/students/externships



Solution to False Front

					110	ווונ	pa.	ye	10					
C	Α	P	R	ı		R	Е	Α	R		P	I	C	
Е	S	S	Е	N		Е	L	M	0		Е	N	0	S
S	K	Е	Р	Т	I	C	1	S	M		R	ı	C	Е
S	0	U		0	N	Е			Α	S	I	M	0	V
N	U	D	Е		Α	S	S	N		K	L	I	N	Е
Α	Т	0	M	S		S	С	Α	R	Υ		С	U	R
			I	L	K		I	R	Α	S		Α	T	Е
	Т	N	T	Е	L	L	Е	С	T	U	Α	L	S	
M	M	I		D	Е	Α	N		E	R	R			
U	Р	C		D	Е	N	C	Н		F	Α	М	Ε	D
Т	Α	Ε	В	0		D	Е	Е	Р		В	Α	R	Ε
Т	R	ı	Α	G	E			Α	R	E		Υ	0	U
E	T	D	S		Α	P	0	L	0	G	Ε	T	T	С
R	Е	Е	K		R	I	F	T		G	R	Α	С	Ε
	D	Α	S		S	Ε	T	Н		S	Α	G	Α	S

Solution to Recruit Me

2	9	5	7	4	1	3	6	8
3	6	1	8	5	9	2	7	4
7	4	8	6			5	9	1
9	2	4	1	6	8	7	5	3
5	8	3	2	9	7	1	4	6
6	1	7	5	3	4	8	2	9
4	7	9	3	1	5	6	8	2
1	5	2	4	8	6	9	3	7
8	3	6	9	7	2	4	1	5

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